LETTERS TO THE EDITOR.

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The Percy Sladen Expedition in H.M.S. "Sea'ark" to the Indian Ocean. The Seychelles Archipelago.[1]

AFTER leaving the *Sealark* and dispatching our collections home, Mr. Forster Cooper and I spent seven weeks in exploring the Seychelles Archipelago as thoroughly as possible, dividing our time between Praslin and Mahé as centres. We camped for eighteen days on the former island, and then separated, Mr. Cooper being responsible for Silhouette Island, the fauna of which appeared to be almost unknown, while I visited various parts of Mahé and examined its reefs and neighbouring islets. Unfortunately the weather had been exceedingly dry, and continued to be so during the first half of our stay, while it was correspondingly wet during the second half. As a result, land collecting was at all times extremely laborious, and insects were throughout found to be scarce, both in species and number. Other groups of land animals we believe to have been fairly thoroughly collected.

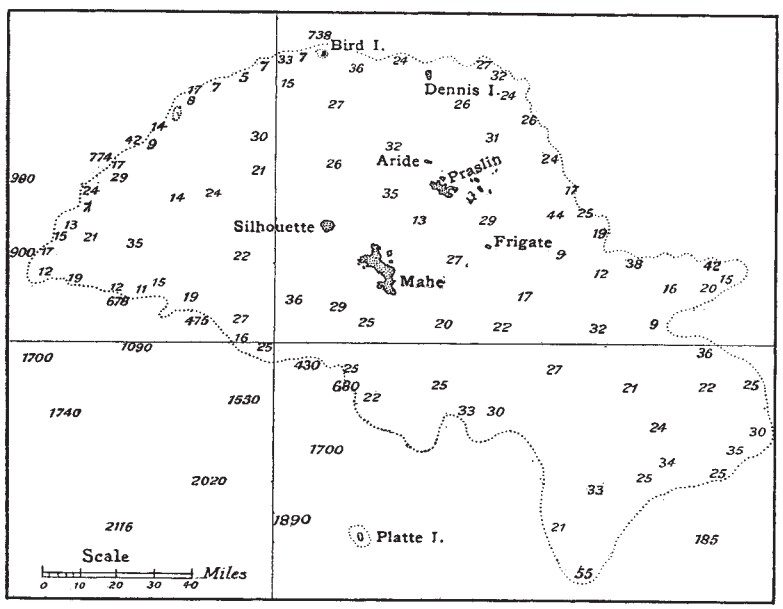

FIG. 1.—Seychelles Bank showing the 100-fathom line.

The Seychelles Archipelago comprises a number of islands arising on a submarine bank, which extends in a more or less east and west direction, about 190 miles long by 100 miles broad (Fig. 1). It was fairly regular in contour save to the south-east, where a horn stretches out for some distance along the line towards Mauritius. Separated from this same projection by deeper water are three similar but smaller banks, of which that of Coetivy alone has land, and in correspondence there is to the south-west the Amirante Bank with its little group of islands.

The Seychelles Bank itself has an average depth of 30 fathoms, and our soundings off it to the north-west, east, and south show that it has a contour similar to those of typical coral reefs and banks. An outer rim is indicated along the whole of its north-western half by a series of shallower soundings, but to the south-east the depth does not markedly shoal (Fig. 1). It has two typical surface-reefs with coral islets to the north, Bird and Dennis, but elsewhere the rim is generally covered by at least 7 fathoms of water. Between these two islands, and to the west of Bird, the character of the bottom is somewhat similar to what we found at the edges of the submerged Saya de Malha and Nazareth Banks, and indicates the upgrowth of a rim. The fauna was more varied, but the bottom was less covered by nullipores and corals, and a few green algæ were abundant. All sedentary organisms were covered with dirt and unhealthy between Bird and Dennis Islands, where there would appear to be a natural outfall for the tidal and other currents. In this position there is certainly no upgrowth of the rim, while elsewhere it must be exceedingly slow. The bottom within the rim is sand, muddy sand, or mud, the latter held together by the roots of algæ. Strong currents sweep across it, and even during our visit, between the two trades in dead calm weather, the sea-water was always cloudy, so that, except in favoured spots, corals could scarcely grow up into reefs.

The islands of the Seychelles naturally divide themselves into two groups to the west and east, with Mahé and Praslin as centres (Fig. 2). The former comprises Mahé, Silhouette, and North, with a series of small islets around the first, outlying buttresses and peaks of the same, with only a few fathoms of water between. Praslin also is similarly surrounded by a series of tiny islets and rocks, but in addition there are eleven other islands in its group (of which we visited five), separated by considerable channels. Mahé and Silhouette attain heights respectively of 2993 feet and 2467 feet, but Praslin and the eastern islands do not exceed 1270 feet. All islands were found to be formed of similar, coarse granites (or granulitic quartzes), with narrow, vertically extending dykes of finer grained black rock, apparently a variety of granite, along which the mountain streams have invariably cut their courses. In addition, many of the islands have against their coasts, in bays and suitable situations, flats of sand, largely coraliferous. Some of these have doubtless been formed by a washing up of sand from the sea, and some are partially at least of delta formation, but in places there is evidence of a recent elevation of more than 30 feet. On the island of Silhouette, Mr. Cooper in five situations found masses of coral rock, cemented on to the granite, at various heights between 15 feet and 30 feet above the low-tide level, and around the coasts of Mahé and its smaller islets there is evidence of a similar upheaval. Besides this, there are indications (particularly in Mahé) of an ancient elevation of upwards of 200 feet. Definite rocks belonging to it do not, so far as I could find, still exist. Marine action prior to its occurrence perhaps accounts for the almost continuous line of precipices, which at various distances from the present coast extends along the eastern or windward side of Mahé. The question, however, requires further investigation. In any case, the deep cañons of many of the mountain brooks, and the very extensive weathering of the granites, indicate the not inconsiderable antiquity of the land as such.

Barrier reefs nowhere exist around the islands of the Seychelles Group, and fringing reefs only in certain somewhat protected situations (Fig. 3). Mahé Island extends more or less north and south, with two conspicuous points to the west. A fairly continuous reef lies along its east side, but there is no reef off its north and south points, and reefs only occur in the bays of its western side. Silhouette is a round island with practically no reef, while Praslin has reefs in its bays alone. La Digne, Curieuse, and the smaller islands have merely patches of reef. On examining into the causes of this we found a luxuriance of coral growth even off the points of the islands, but practically a complete absence of nullipores. Indeed, these calcareous algæ are essential in the Indian Ocean for the consolidation of corals into true reefs. Where fringing flats actually do occur, they would appear generally to consist of a basis

[1] For earlier reports see NATURE, April 13, August 10, October 5, November 9, and December 21, 1905.

of granitic rock with quite a sparse covering of calcareous matter, or to be a filling in with the remains of some of the reef organisms between masses or islets of granite and the land. The reef in the large bay to the north of Praslin, extending along the coast for 1½ miles between two points, is a good instance of this, one islet and three series of granite masses lying at almost equal intervals imbedded in its seaward edge. The boat passages through the reefs are in most situations mere outfalls for the tide, and show no connection with the fresh-water streams off the land. Finally, it is interesting to note that the actual surfaces of the flats are covered with a far greater variety of large seaweeds than we found in any of the purely coral groups we visited in the *Sealark*.

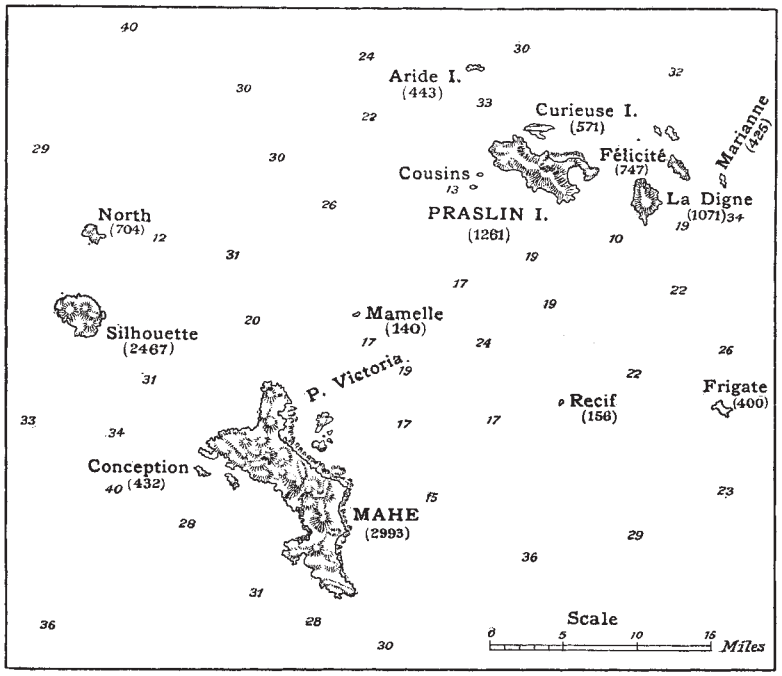

Fig. 2.—Islands of the Seychelles Group with heights in feet and soundings in fathoms.

The land animals necessarily to a large extent depend on the plants, and I considered it inadvisable to attempt their complete collection in the limited time at our disposal save in the indigenous jungle. Small mangrove swamps occur on the sea-shore, but behind these the land has been almost completely cleared for the cultivation of cotton, coffee, cassava, cocoa, and vanilla to a height of 1500 feet. Below this there are only a few isolated endemic trees, and above there are in patches in the jungles large numbers of oranges, limes, citrons, and cinnamons, with an undergrowth of the Mauritius raspberry, all introduced plants. Indeed, there are, except in Silhouette, only a few summits and precipitous slopes which have not been at one time or another completely planted, and it seems possible that even these may be destroyed within a few years for the cultivation of various rubbers. Such jungles as now remain consist mainly of palms (Roscheria, Stevensonia, Nephrosperma, Verschaffeltia), various screw pines (Pandanus), Dracæna, and the bois rouge (Wormia), with bare ground beneath covered by their strong leaves, clumps only of Curculigo. Open spots, however, have a dense undergrowth of ferns, Lycopodia, Selaginellæ, Psilota, and mosses, which also cover the lower parts of the trees. In effect, it is a typical, tropical, moist forest undergrowth, noticeable mainly for the comparative absence of climbing plants and herbaceous dicotyledons, and for the fact that nearly all the larger trees are peculiar Seychelles species, and often genera. Most of the giant trees (Maba, Stadtmannia, Afzelia, Campnosperma, &c.), have been singled out and cut, but bare stems of capucin (*Northea seychellarum*) stand up everywhere above the foliage. The destruction of the latter, which probably will shortly be complete, we discovered to be due to a green beetle, which deposits its eggs singly in the new leaf-buds, the resulting maggot consuming all their softer parts.

The most interesting feature in the botany was the sharp distinction of the cotyledonous plants into three classes, the calciphilous, the siliciphilous, and the indifferents, the latter forming a smaller percentage of the whole than either of the other two. The calciphilous species are practically the same as we found on all the coral islands we visited, and are scarcely more numerous. This group of plants was, I consider, ocean-carried, the Seychelles being in respect to it as oceanic as any island of the Chagos Archipelago. Moreover, of the other trees many seemed to possess seeds, which could have been brought by currents, &c., to the islands. The finest individual species of tree was the coco-de-mer, or double coconut (*Lodoicea seychellarum*), which is peculiar to

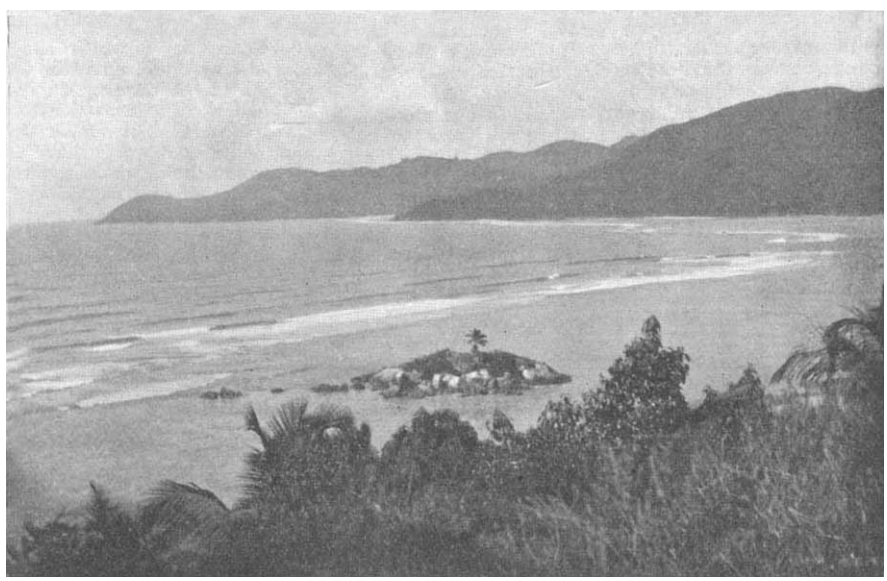

Fig. 3.—Fringing Reef with boat passage to the south-east of Mahé Island, looking south

Praslin. Its palms are either male or female, and our examination of more than 300 of its nuts showed that they are of two distinct, structurally different forms in approximately equal proportions, both kinds growing on the same female tree. The case is, so far as I know, unique.

Of the land animals we did not attempt to collect the birds, as they were already sufficiently known. Moreover, most of the peculiar Seychelles species would seem to have been nearly, if not entirely, destroyed by paid collectors. The Government of the Seychelles has, however, promised an ordinance to hinder further destruction. The introduced birds do not belong to the jungle, where, indeed, land birds are seldom seen. Mammals are represented by rats, mice, and bats, and the tenrec runs wild everywhere. Of reptiles we obtained about eleven species of lizards and three snakes. The crocodile would once seem to have been a regular inhabitant, but the last was killed about seventy years ago. Three of the apparently four species of frogs occur at any elevation, but the fourth is peculiar to the high jungles. Cœcilians are numerous, the one genus being an earth burrower, and the other lying under damp leaves in the jungles. Mollusca were represented among the indigenous vegetation by twenty-five to thirty species, including two slugs, and we obtained a fair variety of insects and arachnids. Isopods were numerous everywhere, but centipedes and millipedes were scarce on the high lands, and seemed to consist of species peculiar to them. We carefully searched for Peripatus, but do not think it exists in the archipelago. Land worms were scarce; one species was peculiar in living within the bases of the screw pine leaves, even 40 feet to 50 feet above the ground. We obtained no land leeches or Turbellarians, but found two species of Nemerteans at about 2000 feet.

The fresh-waters consist of certain pools near the sea and a large number of tiny mountain streams, which become roaring torrents in the wet season, but never dry up. In a pool at La Digne we obtained one tortoise with hinged plastron, and in the streams there were four species of fish. The Crustacea comprise at least two species of prawn and a crab, all living up to more than 2000 feet. The Mollusca number only three, and for the rest there were the usual genera of fresh-water insects, &c.

The number of species of land and fresh-water animals would on the whole appear to be singularly few, and individuals were, with a few exceptions, by no means abundant. Their small variety may be due to the comparatively few plants which grow in the islands, but one is inclined to question the former connection of the group with any larger land mass. In any case, our work has made certain that the archipelago has been sufficiently collected for a thorough examination into this question from a biological point of view. It is our opinion, however, that such a research should include both animals and plants considered together. In any case, the Seychelles is the continuation of a broken line extending north from Madagascar, and its rock would seem to be similar to that which forms the great central plateau of that island.

Since I returned to England I have received a letter from Commander Boyle Somerville giving the soundings obtained by H.M.S. *Sealark* on her return to Ceylon from the Seychelles. He has confirmed by additional soundings the complete separation of the 2000-fathom lines of the Chagos, Maldive, and Seychelles groups. I have also heard from Mr. D. Matthews that he has obtained about 1000 samples of sea-water from the Indian Ocean during the last nine months, and analysed about 700. Mr. Bainbrigge Fletcher, H.M.S. *Sealark*, reports that a considerable number of the Chagos Lepidoptera appear to be new species or varieties.

J. STANLEY GARDINER.

Zoological Laboratory, Cambridge, January 15.

What Causes the Destructive Effects of Lightning?

I ENCLOSE a cutting from the *Hampstead and Highgate Express* (January 20) containing an epitome of a lecture which I lately gave at the local scientific society on a case of death by lightning which occurred on the Heath in the month of July last.

I discussed, amongst other matters, the question as to how the more destructive effects of lightning were produced, and now my object in writing to NATURE is to ask you, Sir, or any of your readers, if you can inform me whether this question has been solved in any probable manner. In the case of the death of an animal from lightning I think we may safely rest on the word electricity as sufficient, for it is not difficult to understand how this form of energy when let loose in the organism of an animal should not only disturb the equilibrium of the machinery, but actually stop it. But the word electricity does not seem sufficient to account for the more destructive effects produced by lightning, which closely resemble those which arise from other well known allied forces. Heat certainly is produced, as we see by the burning of the flesh and by its effects on metals, but as regards the destruction of trees, buildings, and other imperfect conducting substances, the forces seem to be of an explosive character, as are mentioned in the accompanying extract from my lecture.

"The subject which was of most interest to the lecturer was the nature of the destructive agency of the lightning flash, and the present fatal case he thought threw a considerable light upon it. Of course, there was no difficulty in understanding how an electric shock can kill an animal suddenly by bringing the machinery to a stop, when it is considered how fearfully and wonderfully we are made, and that vital processes are at work in every part, when a violent electric shock comes and arrests all these at once. But it is not so easy to perceive how all the more marked and mechanically destructive processes occur, such as the splitting of the timbers in the hut or tearing off the clothes. The destructive effect seemed to be exactly of the kind which follows explosions of gunpowder and kindred substances. This could only occur through a gas being suddenly formed; but whether this would be the production of the vaporisation of a liquid or the formation of some new conditions of the atmosphere by the electricity itself cannot at present be determined. The first object struck by the lightning was the finial, and this was split into numbers of pieces in the direction of the grain of the wood, and the same effect was seen on all the upright posts down which the lightning ran; but, midway across the middle of the hut was a transverse beam, through which the flash passed. At this spot about a foot of the wood was torn off, but in a transverse or horizontal direction in the course of the grain. If a chisel had been driven into the cross beam it would have broken the wood exactly in the same manner; or, indeed, any other force acting on the middle of the splintered wood as an explosive. The coat, and more especially the shirt, showed the explosive force which had produced the rents still better. Although the rents ran down the arm, they had no appearance as if done by an instrument, but rather by a violent pull exerted from side to side, for not only was there one large rent, but similar partial ones running parallel to it. These could only have been done by forcibly stretching from within; in fact, the only way suggested would be an explosion of gas taking place in the shirt sleeve, and so forcibly thrusting it out, causing the fibres of the fabric to give way. The split boot, which was nearly off the foot of the child, could not be imitated except by placing a charge of dynamite within it."

Not professing to have much knowledge of what has been written on the modes and causes of the great destruction caused by lightning, I am writing to obtain more information on the subject. SAMUEL WILKS.

January 20.

The Probable Volcanic Origin of Nebulous Matter.

IN papers published some fifteen years ago (see, among others, Nos. 2 and 4 of *Contributions from the Lick Observatory*) I considered certain phenomena produced by streams of finely divided matter ejected from the sun, each stream necessarily taking on the form of a helix, and stated that the nebulosities surrounding certain stars were probably caused by the presence of streams similar to those which produce the solar corona.

In an effort to explain the fact that in certain spiral nebulas two diametrically opposite streams are, as a rule, most conspicuous, Prof. Chamberlin advanced the theory (see *Astrophysical Journal* for 1901, p. 17) that the disruption of one body through tidal action and centrifugal